# BC Transit Fact Sheet
# SkyTrain Performance

SkyTrain, Greater Vancouver's automated rapid transit system, is proving to be one of the highest performing rail transit systems in North America.

In essence:

- SkyTrain ridership has risen dramatically—58% in four years. It is several times higher than other rapid transit and light rail systems in North America, built in the last decade. Growth continues as riders are attracted by the fast, frequent, service.
- SkyTrain's passenger carrying capacity can be expanded to four times what it is today—from the equivalent capacity of a six lane freeway to that of a 24 lane freeway—without pollution, congestion or parking problems.
- SkyTrain's schedule speed is 65% higher than the average of seven new light rail systems. This high speed, together with frequent service at all hours, is a major factor in attracting riders—and development.
- SkyTrain's vehicle and staff productivity ratings are among the highest in North American rapid transit and light rail systems.
- SkyTrain is the second most energy efficient rail transit system, using only half the energy per passenger-kilometre compared to the average of 11 rapid transit and light rail systems.
- As a result of the high vehicle and staff productivity and low energy consumption, SkyTrain's operating costs are among the lowest in North American rapid transit and light rail systems. The direct operating cost per SkyTrain passenger is one third the cost of moving that passenger by bus.
- After extensive work and new noise barriers SkyTrain is now one of the quietest rapid transit systems in North America.

# SkyTrain: The background

SkyTrain started revenue service in January 1986, and carried 100 million riders in its first four years of service. Today, it carries more than 110 thousand riders each day. Its 25 kilometre route links downtown Vancouver, east Vancouver, Burnaby, New Westminster and Surrey with connecting buses to Coquitlam, Port Coquitlam, Port Moody, Delta, White Rock, Langley and, via SeaBus, to North Vancouver.

Since its inception SkyTrain has been the backbone of an integrated, fully accessible, multi-mode transit system serving British Columbia's Lower Mainland. SkyTrain has acted as an important catalyst. Developments, built or announced along the SkyTrain corridor, exceed $7 billion in value. Developments adjacent to SkyTrain encourage transit use, cutting road and parking requirements, reducing pollution and congestion and increasing mobility and job opportunities.

# Ridership and Capacity

SkyTrain ridership has shown a steady growth, increasing 58% over the last four years including a dramatic 27% increase last year after the extension to Scott Road opened. One sixth of all Greater Vancouver transit passengers now use SkyTrain for all or part of their trip each day.

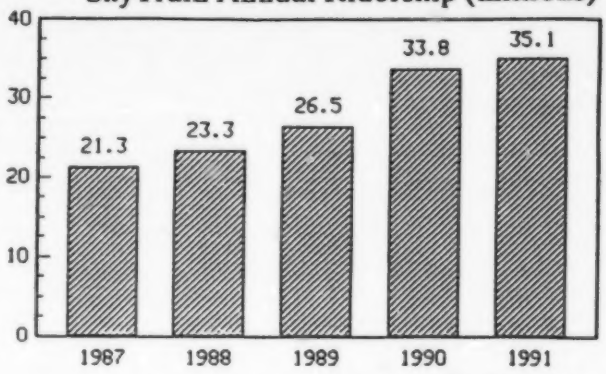
40% of all downtown commuters use transit to and from work. Three quarters of these downtown trips are by electrically powered, environmentally clean SkyTrain, or trolleybus.

SkyTrain's 35 million annual passengers use the system at a rate of 110,000 trips per day. This makes SkyTrain the heaviest used of all new West Coast rapid transit systems.

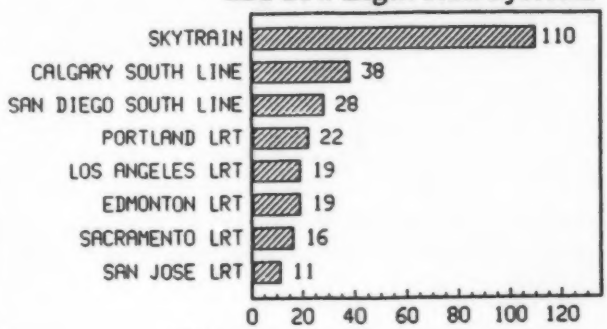
In one direction, during the busiest hour, SkyTrain handles 7,000 passengers over the highest use section between Broadway and Main Street stations. SkyTrain has been designed to handle future growth with ease—by adding cars and increasing the capacity of the automatic train control system and the power supply system. In the future longer trains of the more spacious Mark II cars can each comfortably carry 700 passengers. These trains use the full length of station platforms. At headways of one and a half minutes, forty trains can be operated each hour in each direction, providing an hourly capacity of 28,000 passengers, exactly four times the present peak hour demand.

This future capacity is considerably higher than light rail can provide—unless the light rail is fully grade separated and automatically controlled like SkyTrain.

**SkyTrain Annual Ridership (millions)**

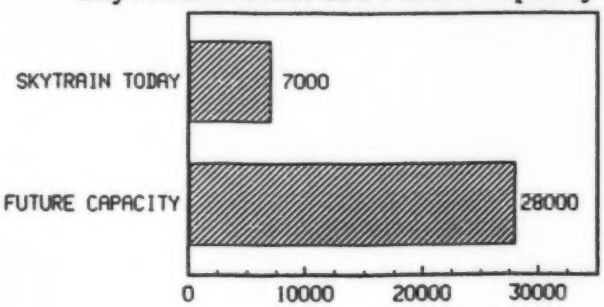



**Daily Ridership on SkyTrain and new Light Rail Systems**




Thousands on busiest single route

**SkyTrain Present and Future Capacity**




Passengers per peak hour direction at the busiest section of the route

28,000 passengers per hour in each direction is more than adequate to cope with all future growth, including planned extensions to Lougheed Mall and Coquitlam Centre. SkyTrain's capacity can be further extended—up to 30%— by using wider cars, longer station platforms and closer headways, but this would involve major capital expense and is unlikely to be necessary.

# Capital Costs

SkyTrain Phases One and Two cost over one billion dollars—$ 1,050 billion for the 24.6 kilometres and 17 stations from Waterfront to Scott Road. This is often compared with Portland's light rail that cost $ 345 million (in the same 1989/90 dollars) for about the same distance—24.0 kilometres.

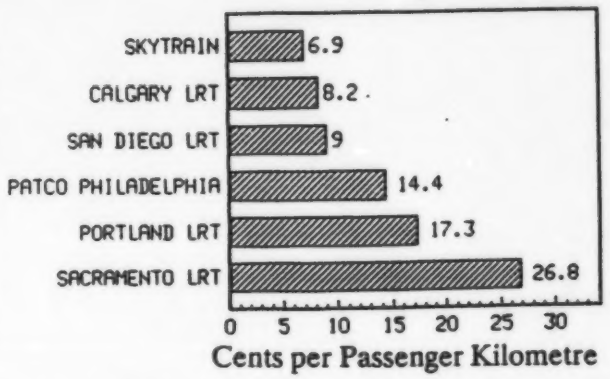
This is not a fair comparison. SkyTrain is carrying 110,000 passengers per day while Portland's light rail is only handling 22,000 per day. A more equitable way to compare systems is to calculate the capital cost per daily passenger. The capital cost per daily passenger for SkyTrain is $ 9,600, while for Portland's light rail it is $ 15,700,—60% higher. New extensions will make SkyTrain look an even better buy. The Whalley extension is estimated to cost $ 127 million and carry 35,000 passengers per day, a capital cost of $ 3,600 per passenger. Portland's new West Side light rail extension is estimated to cost $ 690 million dollars (Canadian) and carry 30,000 passengers per day, a capital cost of over $ 23,000 per passenger.

# Operating Costs

SkyTrain's operating cost is one of the lowest in North America. In addition SkyTrain's automation allows the addition of trains at low cost so that with growth the cost per passenger kilometre will decrease further. SkyTrain also provides roving attendants who provide higher levels of passenger information and assistance than is normal on other light rail or rapid transit systems.

The direct operating cost per passenger kilometre excluding interest or depreciation, and all other data in this fact sheet, are obtained from the *American Public Transit Association 1989 Transit Operating and Financial Statistics* and compared with the SkyTrain fiscal 1990-91 budget and data. Operating costs include overhead, insurance, security and contracted out services. In the case of SkyTrain these include vehicle and station cleaning.

**Direct Operating Cost**




SkyTrain's low operating cost is less than a third the average cost per passenger Kilometre on BC Transit's Vancouver bus system. If all SkyTrain passengers were being carried by bus it would add $66 million to BC Transit's annual operating costs. Of course it would not be possible to move 35 million additional passengers per year by bus on this corridor. Firstly buses would not attract as many passengers-nor the development that is surrounding SkyTrain stations. Secondly there would not be sufficient road capacity. At present SkyTrain ridership levels the corridor would need a six lane freeway and another major bridge. Today SkyTrain takes 5,000 cars and their pollution off local streets in a single peak hour. In the future SkyTrain has the capability to handle four times more passengers than today—equivalent to a 24 lane freeway—but without most of the negative environmental impacts.

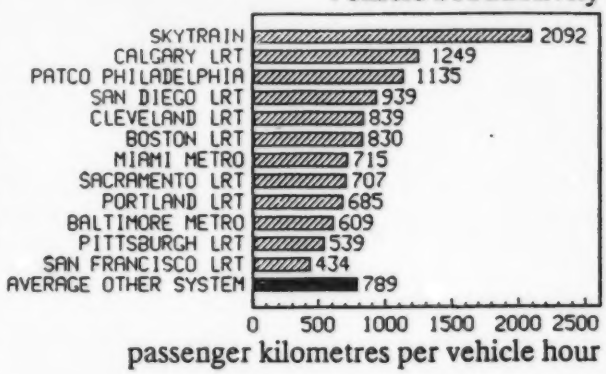
# Efficiency

***SkyTrain's low operating cost is due to the efficient use of vehicles, staff and energy.***

**VEHICLE PRODUCTIVITY** With a schedule speed from end to end of the line, of 43 km/h, SkyTrain is fast compared to the average of 26 km/h on seven new light rail systems. SkyTrain vehicle availability is the highest in North America. In 1990 108 of 114 cars were used in the peak period. This 95% availability compares with a range of 80 to 88% on new light rail systems.

Two SkyTrain cars, called a married pair, have the same capacity as a single articulated light rail vehicle. Combining the high availability with the 65% higher speed results in a vehicle productivity of 2,090 passenger kilometres per married pair hour, two and a half times higher than the average of 11 new rail transit systems.

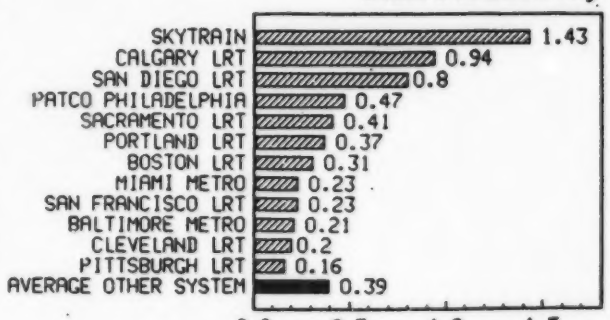
**Vehicle Productivity**




passenger kilometres per vehicle hour

**STAFF PRODUCTIVITY** SkyTrain staff productivity is exceptional. It is more than double the average of five west coast light rail systems and three and a half times higher than the average of the 11 systems listed. Staff productivity is calculated by dividing the annual passenger-kilometres by the number of employees. Part time employees are converted into equivalent full-time positions. Systems with a common management between light rail, rapid transit and buses distribute common expenses—such as management, supervision, insurance and security—between modes, in accordance with UMTA Section 15 rules.

**Staff Productivity**



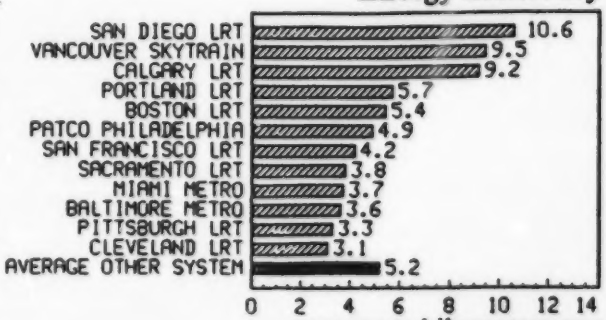

million passenger kilometres per employee

**ENERGY EFFICIENCY** SkyTrain is the second most energy efficient system, after San Diego's light rail. SkyTrain's energy consumption per passenger-kilometre is just less than half the average of the other systems listed.

The criteria for energy efficiency is the number of passenger-kilometres per Kilowatt Hour of electricity used for propulsion. Energy used includes air conditioning and heating loads, putting some systems—such as those on the East Coast—at a disadvantage.

In comparison with the automobile SkyTrain uses less than one tenth of the energy per passenger-kilometre. SkyTrain uses two fifths the energy (38%) per passenger-kilometre of a BC Transit diesel bus.

**Energy Efficiency**




passenger kilometres per kilowatt hour of electricity

# Noise

In the first years of operation high noise levels, from corrugations that developed on the rail running surfaces, presented a major problem. BC Transit approved a one million dollar multi phase noise reduction program, following a report from the B.C. Ombudsman. Corrective action was completed in 1991 and independent measurements were made by the acoustic consulting firm Barron, Kennedy, Lyzun & Associates.

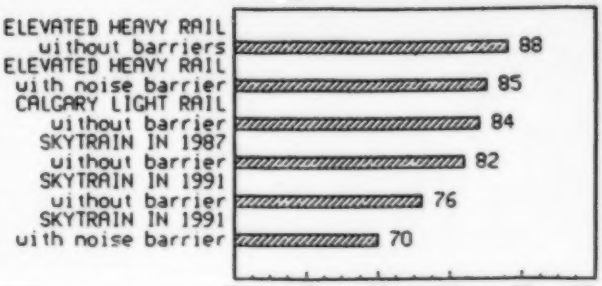
Today SkyTrain is one of the quietest rapid transit/light rail systems in North America.

Noise standards in North America are set in terms of 24 hour averages. These take into account train frequency which is higher for SkyTrain than most light rail systems.

SkyTrain noise levels meet the residential noise standards in Burnaby — 62 $Leq_{24}$ dBA and, with barriers, those of Vancouver — 55 $Leq_{24}$ dBA. SkyTrain noise levels are below those of traffic on main roads and are a half to a quarter the levels of light rail in comparable circumstances.

SkyTrain's maintenance program is based on maintaining these low noise levels by grinding rail and turning wheels periodically. Noise barriers have been installed at all sensitive residential areas along the SkyTrain route.

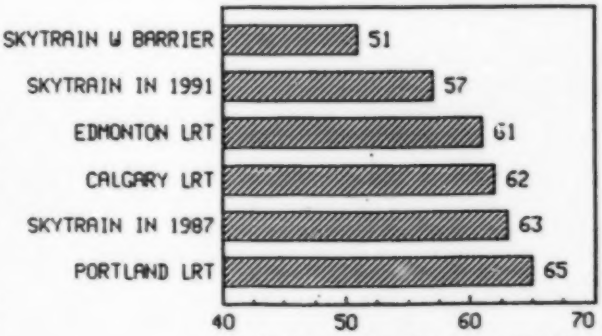
**Single Train Noise Levels**




Single event noise in decibels on the 'A' scale for a multiple car train at a speed of 80 km/h (50 mph) and at a distance of 15 metres—50 feet

Noise varies from train to train and with weather conditions. Levels will range from 4-6 dBA below, up to the maximum levels shown on this chart.

**Average Noise Levels Over 24 Hours**




Decibels on the 'A' scale, 24 hour average ($Leq_{24}$ dBA) for a multiple car train at a speed of 80 km/h (50 mph) and at a distance of 15 m—50 ft.

Elevated Rapid Transit data from DAVID A. TOWERS P.E., DR. ROBERT P. KENDIG. *Noise Impact of Elevated Structures in United States*. Urban Rail Transit Systems. American Public Transit Association, Rail Conference, San Francisco 1980. SkyTrain and Light Rail data from BARRON, KENNEDY, LYZUN & ASSOCIATES *An Investigation of Noise for the Vancouver/Richmond and Coquitlam Extensions*. . . . May 1991. Some rapid transit and light rail systems do not reach 80 km/h. In these cases noise readings were extrapolated using industry accepted formula.

NOTE On the logarithmic decibel scale each 3 dBA represent a halving of noise levels. 3 dBA less is half the noise level, 6 dBA less is a quarter the noise level. Noise energy falls in half as the distance from the train doubles. For example at 30 metres the single train noise levels will drop 3 dBA from the data shown for 15 m. Data are for trains on modern, concrete, elevated guideway. Steel structures tend to be noisier, ground level (at-grade) sections quieter.